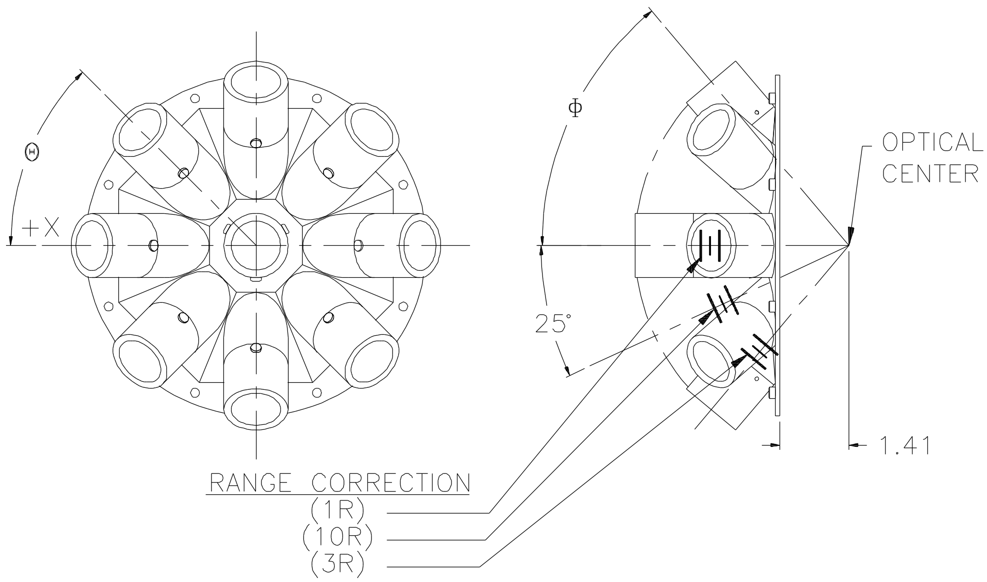
Figure 5.1-2 shows the array geometry. The optical center is defined as the center of the sphere whose surface is tangent to the faces of the retroreflector cubes. The range correction provided later in this report adjusts the apparent reflection point of the laser back towards this optical center along the line of sight to the array.



5.2 Summary of Results

Table 5.2-1 provides a summary of the analyses performed. Runs have been done looking directly at each retroreflector and at two additional points. One geometrically centered between two radially oriented cubes and one geometrically centered between three cubes (two radial and the nadir cube). Cross section is given in units of 10^6 square meters.

In Table 5.2-1 the following column titles and their definitions apply:

- Fig: the figure number in Appendix C (for this specific case)
- θ and ϕ: incidence angles on the array, corresponds to azimuth and elevation, but as used here are based on an array based coordinate system (see figure 5.1-2)
- Retro: the position number of the retroreflector being viewed directly.
- Avg Dihed Offset: average dihedral angle offset in arcseconds for the retroreflector being viewed.
- Cross Section: 25: average cross section around a circle of radius 25 microradians in the far field
  25-50: the average signal in the annulus of 25-50 microradians
  50: and the average signal around a circle of radius 50 microradians in the far field.

Fig	q	f	Retro	Avg Dihed Angle	Cross Section (10^6 meters)		
					25	**25-50**	**50**
1	0	0	9	1.322	0.84	0.51	0.19
2	0	50	1	1.436	1.11	0.65	0.29
3	45	50	2	1.311	1.11	0.63	0.25
4	90	50	3	1.612	1.09	0.68	0.38
5	135	50	4	1.389	1.09	0.53	0.30
6	180	50	5	1.744	1.03	0.68	0.43
7	225	50	6	1.358	1.09	0.65	0.29
8	270	50	7	1.604	1.08	0.66	0.36
9	315	50	8	1.808	0.99	0.67	0.44
10	22.5	25			0.77	0.41	0.24
11	22.5	55			0.63	0.44	0.25

Table 5.2-1-Cross Section.

The active reflecting area is less when looking at the pole retroreflector (Retro 9, table 5.2-1) than when looking at one of the eight retroreflectors in the ring tilted at 50°. As a result, the average signal strength is less. This is not an indication that this retroreflector is any worse than the others are. It is because the other eight retroreflectors are not adding as much to the signal for this incidence angle. This is not a problem since the satellite would be directly overhead where the range is the shortest and atmospheric transmission should be the best.

For each cross section run shown in table 5.2-1 there is a corresponding range correction calculation. The discrete values of range correction are shown in the plot in appendix C. To summarize this data, table 5.2-2 shows the average around circles in the far field between 25 and 50 microradians. The minimum and maximum range corrections are also provided. Note that these minima and maxima are the minimum and maximum of the averaged values, not the absolute minimum and maximum discrete points. These values in table 5.2-2 show that there is no systematic variation in the range correction as a function of the magnitude of the velocity aberration. The range correction plots in appendix C correlate to the cross section plot in numbered pairs. For example figure 1 is the cross section and figure 1R is the range correction for a given incidence angle on the array.

Fig.	Range Correction (meters)		
	Min	**Max**	**Avg**
1R	.0784	.0829	.0810
2R	.0783	.0811	.0797
3R	.0771	.0808	.0790
4R	.0788	.0806	.0796
5R	.0783	.0810	.0796
6R	.0793	.0805	.0798
7R	.0770	.0807	.0788
8R	.0791	.0809	.0799
9R	.0797	.0807	.0802
10R	.0716	.0724	.0719
11R	.0791	.0792	.0792

Table 5.2-2 Range Correction in Meters.

The range correction value is an adjustment to the measured range that will move the point of optical reflection to the optical center of the array as defined in figure 5.1-2. The surface of optical reflection is a three dimensional shape approximating a bumpy hemisphere (since the array itself approximates a hemisphere). The optical center defined in figure 5.1-2 is the center of a sphere on which the front faces of the retroreflector cubes are tangent. The range correction is a number which when added to the measured range, offsets the measurement towards the optical center. Three range correction cases are identified figure 5.1-2. They correspond to the data and plots for the respective plot numbers (1R, 10R and 3R) in figure 5.2-2. The average range corrections are shown in that figure by the short lines that fall within the small error bands (which represent the minimum and maximum range correction). Adding the range correction to the measured range adjusts those apparent points of reflection to the optical center of the retroreflector array.

The analyses presented model returns normal to each cube face. For the ring of eight cubes the range correction average is from 7.88 to 8.10 cm. The range correction for θ=22.5° and ϕ=25° is about six mm less than the other range corrections. The reason for this is that these points in the array are furthest from being normal to a particular cube face, the condition for which most of the runs have been modeled. The ground laser must actually travel further before hitting the retroreflectors in this configuration that when a cube face is normal to the laser beam.

The variations in range correction shown are well within the one cm design goal. Using an average range correction of about 7.7 cm will keep the error due to orientation within 0.4 cm.